KOMA ELEKTRONIK

KOMA Elektronik FT201
Analog State Variable Filter / 10 Step Sequencer

USER MANUAL
version 1.0

TABLE OF CONTENTS:

3. Introduction
4. Getting Started
5. Features
7. Control Voltage Theory
9. Patch Bay
11. Basic Settings and Examples
13. Technical Specifications
15. Warranty

WARNING:

Ony use the KOMA Elektronik power supply shipped with the FT201. Power sources rated with voltages greater than 9V DC and/or wrong polarity may cause damage or malfunction to the FT201's circuitry and will void the warranty!

Introduction

Filters are possibly *the* sound tool per se when it comes to defining your own sound. There's a lot of discussion going on about different filter topologies and their respective sound and how to electronically solve these different approaches. At KOMA Elektronik we went for a very versatile filter architecture called *state variable filter*. One of the advantages of this filter is that you have band pass, high pass and lowpass characteristics available simultaneously for a given input. Other musically convenient advantages are the independently adjustable Q (resonance) and gain that can be set without affecting other variables.

There are two gain cells in the signal path of a voltage-controlled state variable filter so there are different approaches to represent those gain cells. Usually these gain cells are represented by an IC called 'transconductance amplifier' (a small chip) but for the FT201 we decided to take another electronic part here commonly known as 'vactrols'.

What is a vactrol? Basically it's a light dependent resistor (LDR) and a LED kissing each other under a lightproof plastic blanket. When you send current through the LED, it shines brighter, therefor the resistance of the LDR decreases and vice versa. Vactrols are great for sound applications because they are not prone to distortion and are known for their soft and organic, analog sound.

Sequencers on the other side are great tools for modulation, possibly the most logic thing after a simple knob. With the onboard step-sequencer you can twiddle with charming frequencies and their resonant overtones or find a pretty pattern to go through your tone. With the sequencer output on the patch bay you can control other features of the pedal as well as other KOMA Elektronik pedals or synthesizers that accept control voltage.

Combining these two sound tools brings up a whole new variety of defining your sound and playfully work with it.

GETTING STARTED

1) **Unpack your machine:** The package comes with the FT201 pedal, a +9VDC, 500mA, tip-negative power supply, a small bag with 4 knobs and this manual. Save the box and packaging material in case you ever need to ship your pedal! Make sure that the power supply is rated for the line voltage of your country: 120 VAC for the USA, 220 VAC for Europe or most other countries.

   Take the small knobs from the bag and gently push them in the holes of the backpanel of the FT101. Please do this carefully! You can always take them out again when you transport the pedal, this to make sure the attenuators on the back don't break down. When the pedal is shipped, all the attenuators are turned fully counter clockwise and the trimmer for the SENSOR is set fully clockwise.

2) **Connections:** Connect your instrument to the FT201 by using the AUDIO INPUT on the patch bay. Connect the LO PASS of the FT201 to your amp. To connect the Motion Controller (the built-in expression function) plug in a ¼ inch jack cable from SENSOR to DLY TIME CV on the patch bay.

3) **Set up the FT201/ Amp:** Set all the rotary controls on the FT201 to 0. Turn down the volume of your amplifier.

4) **Power up / Bypass:** Connect the FT201 power supply to the FT201 DC input on the backside of the pedal. The LED on step 1 of the sequencer will come up for a second and then go off again. When you press the bypass switch the EFFECT ON/OFF led will light up, this means the effect is ON.

5) **Set levels:** Turn on your amplifier. Make sure the EFFECT ON/OFF indicator is OFF. Play your instrument and adjust the volume of the amplifier so it is at a comfortable level. Press the Bypass switch and the EFFECT ON/OFF indicator will turn on green which means the effect is active.

6) **Play:** Now go nuts. If necessary, adjust the INPUT GAIN slider control to match the levels of the processed signal and the bypassed signal. Be aware of volume changes in your signal when using the FT201. This is especially true when the RESONANCE slider control is set to HIGH, don't turn it up too much, you'll get crazy and very high pitched sounds!

   You can use the Motion Controller to adjust the EXTERNAL CLOCK, CUTOFF, RESONANCE and SEQUENCER RESET. Be sure to read through the Control Voltage Theory section to understand all CV features and the way to use them properly.

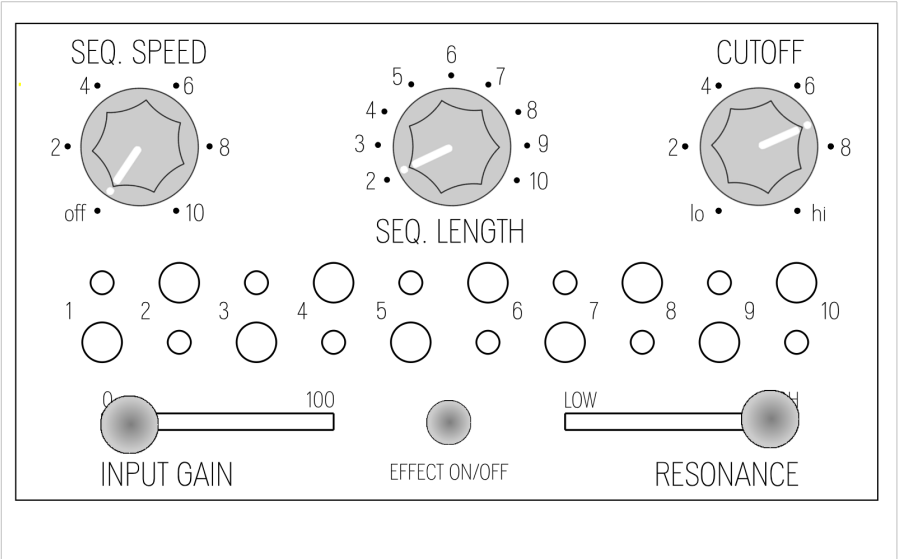


Fig.1 Frontpanel Features

Input Gain

The INPUT GAIN slider of the FT201 provides you with an adjustable gain for boosting low level input signals. By sliding from left to right you can boost your signal from zero gain to 100 gain (0 to +20dB).

Filter

The use of the filter section of the FT201 is pretty straight forward. There is the CUTOFF knob with which you set the cutoff frequency for the filter, simultaneously for all three filter characteristics. Fully counter-clockwise sets the cutoff frequency to the lowest and fully clockwise to the highest frequency.

The RESONANCE slider sets the Q of the filter, better known as resonance. The resonance of a filter determines the gain increase of the signal at the cutoff frequency. Set it to LOW (left) to leave the signal gain at cutoff frequency at zero and slide it to HIGH (right) to hear plenty of resonance at the given cutoff frequency. Be aware of the fact that the filter will start self-oscillating when you are at or near maximum resonance.

Sequencer

The sequencer is divided into two parts: A control section and the actual sequencer itself. The control section consists of the two knobs named SPEED and SEQ. LENGTH. The SPEED knob sets the speed of the sequencer which means the time it takes to go from one step to the next one and at the same time also the duration of each single step (On the scale that means: 10 is the slowest, 2 is the fastest). If you turn the SPEED knob fully counter-clockwise you can turn the sequencer off with a 'click' (there's a built-in switch in the potentiometer).

The SEQ. LENGTH knob is a rotary switch with which you can choose the length of the sequencer pattern from 2 – 10, i.e. after which step the sequencer will go back to step 1. The currently active step is indicated by a small red LED next to the step number.

Underneath these controls you find 10 small knobs that set the value of each step. It is easy to imagine these ten knob as duplicates of the CUTOFF knob mentioned earlier. The amount set with the sequencer knob of the active step is added to the current setting of the CUTOFF knob, or in other words: You can shift the sequencer pattern up and down with the CUTOFF knob, similar to setting a bias voltage for incoming CV signals. The sequence is also present at the SEQUENCER output on the patch bay.

Sensor

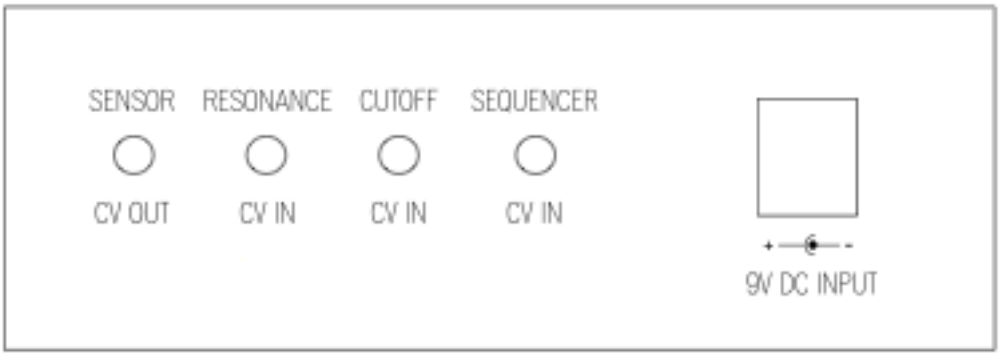
One of the features on your FT201 you won't find in any other pedal is the possibility to control the features of the pedals with the on board motion controller. Since its working with infrared LEDs we call it the SENSOR. The motion controller can be used in many different ways. Technically speaking, it emits a CV signal (control voltage) which can be patched up with any CV receptive socket on the KOMA pedals and f.i. on your modular system. By moving your hand over the sensor you can control the parameters of the CV input you patched it up to. With the trimmer on the back of the pedal (it says SENSOR) you can change the sensitivity of the motion controller. For more information about control voltage, check out the section Control Voltage Theory of this manual.

Control Voltage Theory

The concept of control voltage (CV) is not hard to understand: Instead of turning a knob on your pedal you simply connect a voltage – the control voltage – to the corresponding CV input that does the job for you. So for example if you want to make fast changes to the cutoff frequency you don't have to turn that knob all the time back and forth fast but simply connect an alternating CV to the CUTOFF input.

You can take control signals from any source for controlling the inputs of the FT201. All of the CV inputs theoretically accept control voltages from -100V to +100V though a range from -5V/-12V/-15V to +5V/+12V/+15V is more common and usable.

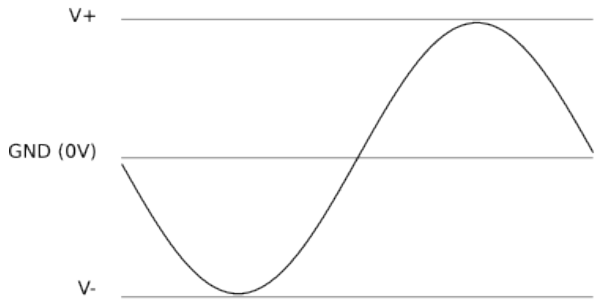
Since the FT201 is running on a +9V power supply you might wonder how you can use a signal as large as -15V to +15V. The answer is simple: We provide you with a trimmer for each CV input on the backside of the panel.



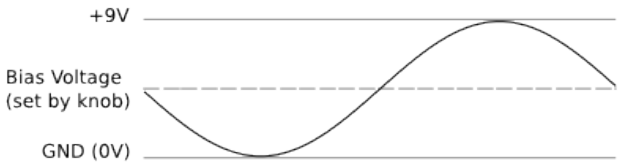
So whenever you notice a significant distortion or clipping in your control signal waveform or strange CV behavior simply turn the trimpot clockwise (away from the word 'CV') until you hear your desired result. By turning it clockwise you attenuate the incoming CV signal. Fully clockwise (CW) means that the incoming CV signal is completely gone, whereas fully counter-clockwise (CCW) means that the incoming CV signal is arriving to the circuit unattenuated.

In addition to that you can set an offset voltage to your control voltage to adjust the CV signal to your needs. The offset voltage is set by the corresponding knob on the front panel. There's also a distinction between bipolar and unipolar signal. This is best explained with a few pictures.

Bipolar CV Signals



Original CV Signal



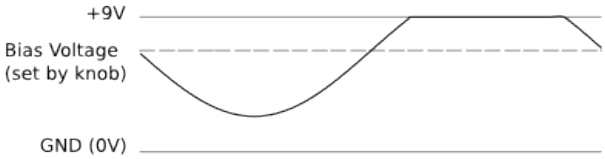
CV Signal inside the pedal

So, what happens? The incoming CV signal is shifted around the voltage that you select with the corresponding knob. Example: if you insert a -5V to +5V sine wave into the RESONANCE CV jack you will get the following results while turning the RESONANCE slider:

Bipolar CV Signals

Original CV Signal

Low Bias Voltage

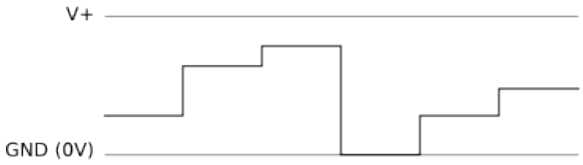


CV Signal inside the pedal

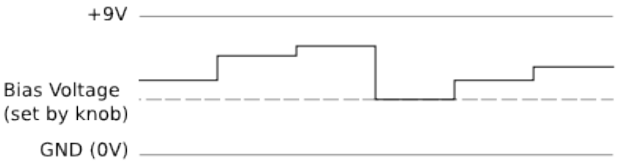
High Bias Voltage

A similar thing happens to unipolar CV signals: Their point of origin (0V) is shifted by the amount set with the corresponding knob. In other words: You add the voltage of your knob to the voltage of your incoming unipolar CV signal.

Unipolar CV Signals



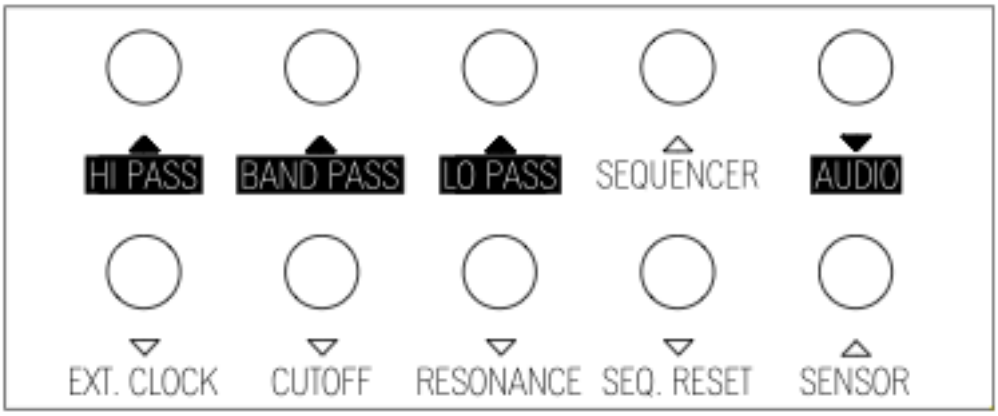
Original CV Signal



CV Signal inside the pedal

Now you understand control voltage, let's see what the patch bay of the FT201 can offer.

PATCHBAY



The patch bay consists of ten 1/4" jack sockets which you can use for receiving and sending various audio or control voltage signals. Blank arrows mark CV inputs/outputs, black arrows mark audio inputs/outputs. If the arrow is pointing towards the jack socket it shows you that this is an output, if the arrow is pointing away from the jack socket it is an input.

The FT201 was designed to accept unipolar CV only. Since the pedal runs on +9V every time you plug in a control voltage to one of the CV accepting inputs, the respective knob (e.g. SPEED knob or SPEED IN (CV input) determines the offset voltage of your CV input signal.

Let's start from right to left in the upper row.

AUDIO IN (audio input)
This is the main audio input of the FT201. The sound source plugged in here will go trough the whole effect section.

SEQUENCER OUT (CV output)
This is the output of the sequencer, ranging from 0 – 7V. Note that this is the sum of the sequencer itself *and* the the CUTOFF knob.

LOWPASS (audio output)
This is the lowpass output of the filter.

BANDPASS (audio output)
This is the bandpass output of the filter.

HIGHPASS (audio output)
This is the highpass output of the filter.

Left to right, lower patchbay row:

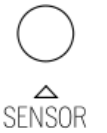
EXT. CLOCK (CV input)
The EXT. CLOCK input is able to accept clock signals for the sequencer by overriding the internal clock set by the SPEED knob. It reacts to rising edge triggers, proceeding one step whenever a trigger or gate signal arrives. (see Control Voltage Theory section).

CUTOFF (CV input)
The CUTOFF CV input controls the cutoff frequency of the filter. When you insert a control voltage into this input the CUTOFF knob determines the offset voltage (see Control Voltage Theory section).

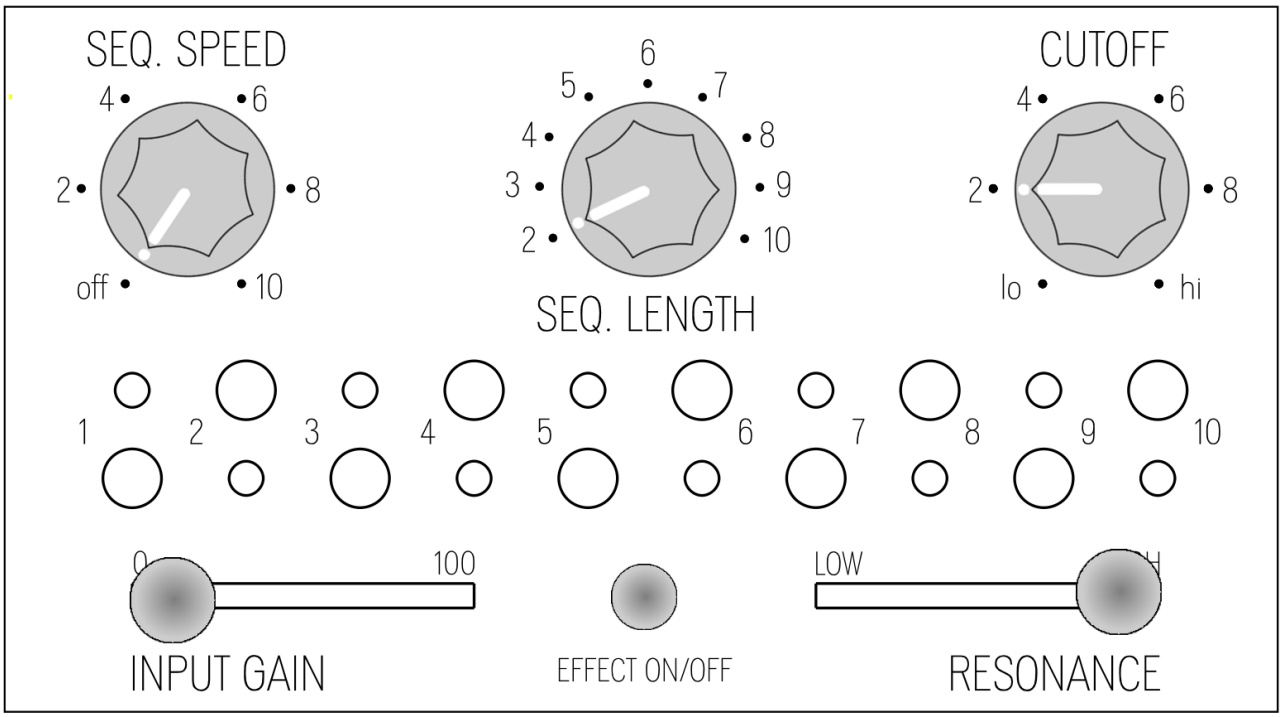
RESONANCE (CV input)
The RESONANCE CV input controls the amount of resonance in your given filter setting. When you insert a control voltage into this input the RESONANCE slider determines the offset voltage (see Control Voltage Theory section).

SEQ. RESET (CV input)
A rising edge trigger or gate signal arriving at this CV input resets the sequencer to step 1. (see Control Voltage Theory section).

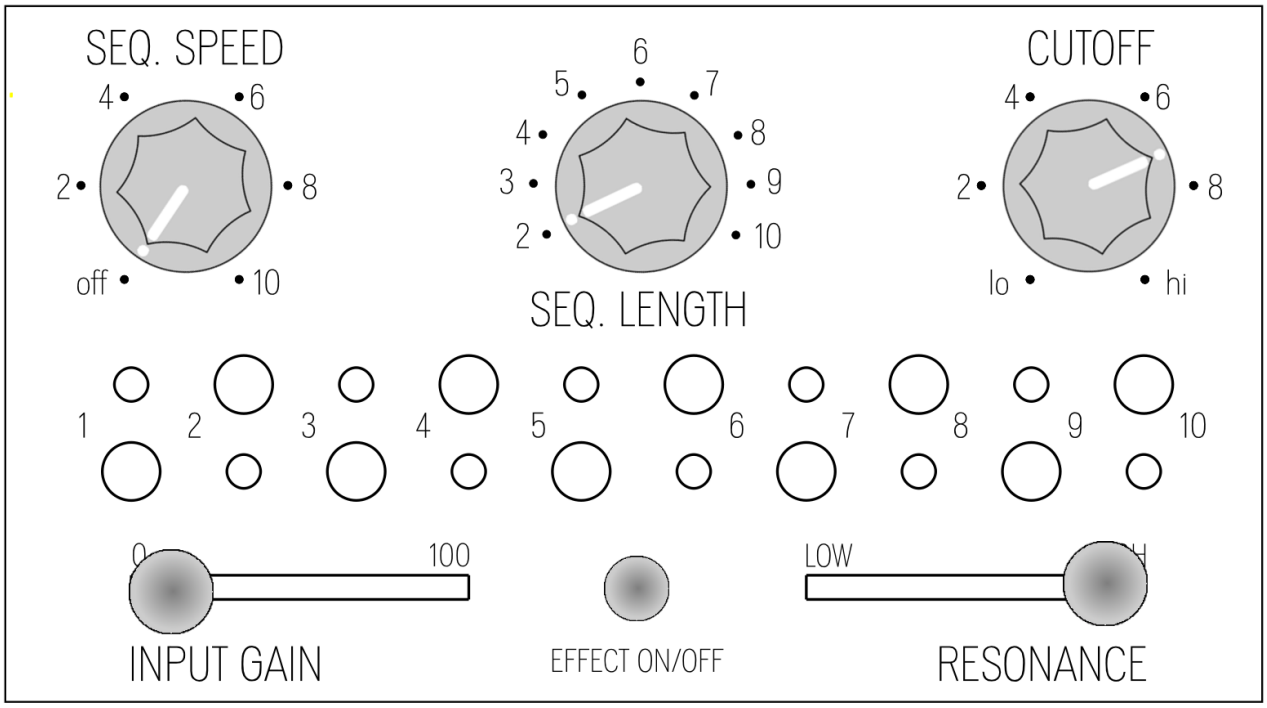
SENSOR (CV output)
This is the CV output of the infrared motion sensor. The closer you move something towards the sensor, the higher the CV raises. You can set the sensitivity of the sensor with a small trimmer on the background called 'Sensor'. The sensor output is 0 – 9V.



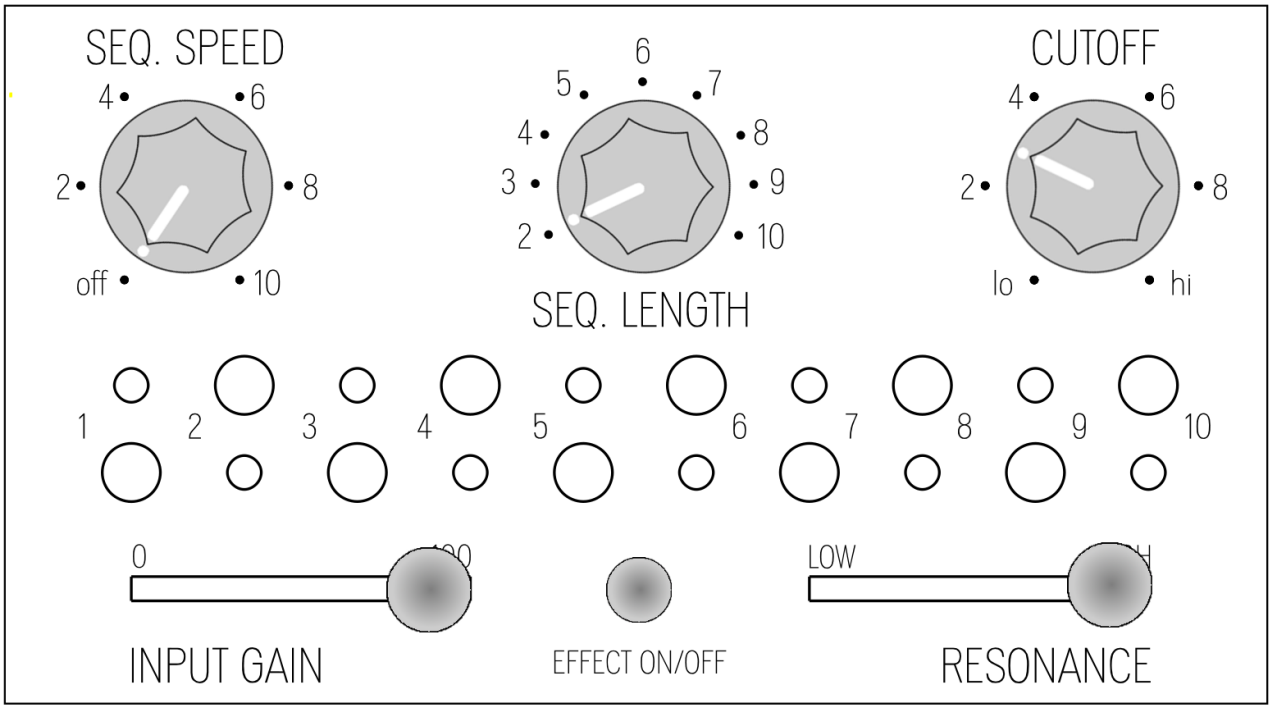
Deep Bass Punch
(plug your amp into the LO PASS output)



High tones resonance
(plug your amp into the HI PASS output)



Distorted Low Frequencies (great for bass synths)
(plug your amp into the LO PASS output)



Technical Specifications

General
Case: Powder coated aluminium casing, silkscreened text and wooden side panels.
Dimensions: 23 cm x 15 cm x 5.5 cm (L x W x H) / 9.1″ x 6″ x 2.2″ (L x W x H).
Net. Weight: 0.8 kg / 1.8 lb.
Shipping Weight: 1.0 kg. / 2.2 lb including power adapter and instruction manual.
Power requirements: 9V DC power adapter, 500mA, center polarity negative
(only use the KOMA adapter shipped with the pedal)

Features
INPUT GAIN - slide control which allows the user to set the input gain of the plugged in instrument or line audio signal.
RESONANCE - slide control to set the resonance of the filter. Please note that due to tolerances in the vactrols every filter sounds a bit different and amounts of resonance can vary with each pedal.
SPEED - rotary control to adjust the clock speed of the built-in sequencer. If turned fully counter clockwise, the sequencer is off and not routed to the cutoff of the filter anymore.
SEQ. LENGTH - rotary switch for defining the length of the sequencer pattern from 2 - 10 steps.
CUTOFF - rotary control to to adjust the cutoff frequency of the filter.
SEQUENCER CONTROLS (1 - 10) - rotary controls to set the control voltage of each step of the sequencer pattern. The sequencer is running through the selected amount of steps from left to right and adds the control voltage to the the value set by the CUTOFF knob, thus modulating the cutoff frequency in every step.
EFFECT ON LED - indicates if the effect is switched on or bypassed.
FOOTSWITCH - Heavy duty Alpha foot switch. Turning the effect on or off.
2 IR EMITTERS, 1 IR RECEIVER - calculates the distance between an object and the pedal and generates a CV signal according to the measured distance. The CV output of this sensor appears as a CV output on the patch bay from where you can route it to the CV input of your desired, to-be-modulated feature.

Patchbay
AUDIO IN - plug your sound source here.
HI PASS, BAND PASS, LO PASS - outputs of the three respective filter characteristics. All three filter outputs are available at the same time.
SEQUENCER - CV output of the control voltage generated by the sequencer and CUTOFF knob.
EXT. CLOCK - CV input for the clock generator of the sequencer. Applying a clock signal here lets you control/sync the speed of the sequencer by external clock sources. Try it with the built-in motion sensor!
SEQ. RESET - CV input of the sequencer. Every time a gate signal (rising edge trigger) is fed into this CV input, the sequencer is reset and starts again at step 1. Nicely playable with the built-in motion sensor.
CUTOFF - CV input that lets you control the cutoff frequency of the filter with an external CV source or the built-in motion sensor.
RESONANCE - CV input that lets you control the resonance of the filter by means of an external CV source of the built-in motion sensor.
SENSOR - CV output of the onboard motion sensor for usage with CV inputs on the pedal, other KOMA Elektronik pedals or other voltage-controlled devices.

Backpanel

DC POWER INPUT jack – accepts standard 9 volt power adaptors, center pin negative, 500mA min. (KOMA Elektronik power adaptor included).

CV TRIMMERS - The sensitivity of the CV inputs and outputs as well as the sensitivity of the motion sensor can be adjusted with attenuators which are mounted on the back of the pedal.

All patch bay inputs and outputs are mono 1/4″ phone jacks.

KOMA Elektronik warrants its products to be free of defects in materials / workmanship and conforming to specifications at the time of shipment for a period of two years from the date of purchase. During the warranty period, any defective products will be repaired or replaced, at KOMA Elektronik's option, on a return-to-factory basis. This warranty covers defects that KOMA Elektronik determines are no fault of the user.

Returning Your Product?

You must obtain prior approval in the form of an RMA (Return Material Authorization) number from KOMA Elektronik before returning any product. Click “Service” in the Support menu on the KOMA Elektronik website (www.koma-elektronik.com) to request the RMA number . All products must be packed carefully and shipped with the KOMA Elektronik supplied power adapter. Sorry, the warranty will not be honored if the product is not properly packed. Once you have received the RMA# and carefully packed your product, ship the product to KOMA Elektronik with transportation and insurance charges paid, and include your return shipping address.

What will we do?

Once received, we will examine the product for any obvious signs of user abuse or damage as a result of transport. If the product has been abused, damaged in transit, or is out of warranty, we will contact you with an estimate of the repair cost. Warranty work will be performed and KOMA Elektronik will ship and insure your product to your European / USA address free of charge.

How to initiate your warranty?

Please initiate your warranty online at www.koma-elektronik.com. Click “Product Registration” in the Support menu to register your product. If you do not have web access, fill out all the information on a letter and mail to:

KOMA Elektronik VOF
Postfach 610383,
10926 Berlin
Germany